

REMARKS

This response is intended as a complete response to the Office Action dated May 11, 2006. In view of the following discussion, the Applicants believe that all claims are in allowable form.

CLAIM AMENDMENT

Claim 32 has been amended to correct an error in dependency. Specifically, claim 32 has been amended to depend from claim 21. The Applicants submit that this amendment was made for reasons unrelated to patentability and that no new matter has been added.

CLAIM OBJECTIONS

Claim 28 stands objected to due to minor informalities. Specifically, the Examiner suggests inserting a comma after the term "nitrogen." In response, the Applicants have amended claim 28 in the manner suggested by the Examiner. Accordingly, the Applicants respectfully request that the objection be withdrawn and the claim allowed.

CLAIM REJECTIONS**A. 35 USC §112 Claims 9, 13-16, 19-20, 22, and 24**

Claims 9, 13-16, 19-20, 22, and 24 stand rejected under 35 USC §112, 2nd paragraph, as being indefinite for failing to particularly point out and distinctly claim the invention. In response, the Applicants have amended claims 9 and 22 to more clearly recite aspects of the invention. Claim 24 has been cancelled.

Specifically, claim 9 has been amended to more clearly define the plasma constituents. Claims 13-16 and 19-20 depend from claim 9. Claim 22 has been amended to correct the recited temperature range.

Thus, the Applicants submit that claims 9, 13-16, 19-20, and 22 comply with the requirements of 35 USC §112, 2nd paragraph and are patentable thereunder. Accordingly, the Applicants respectfully request the rejection be withdrawn and the claims allowed.

B. 35 USC §102 Claims 1-3, 7-9, 10-12, 14-16, 19-23, and 29-30

Claims 1-3, 7-9, 10-12, 14-16, 19-23, and 29-30 stand rejected under 35 USC §102(b) as being anticipated by United States Patent 5,545,289, issued August 13, 1996 to *Chen, et al.* (hereinafter *Chen*). In response, the Applicants have amended claims 1 and 21 to more clearly recite aspects of the invention.

With respect to 35 USC §102, or “anticipation,” the Federal Circuit has repeatedly stated that “there is no anticipation unless all of the same elements are found in exactly the same situation and united in the same way . . . in a single prior art reference.” *Perkin-Elmer Corp. v. Computervision Corp.*, 732 F.2d 888, 894 (Fed. Cir., 1984); *Kalman v. Kimberly-Clark Corp.*, 713 F.2d 760, 771, 218 U.S.P.Q. (BNA) 781, 789 (Fed. Cir. 1983). Here, *Chen* does not identify each of the claimed elements as arranged in independent claims 1 and 21 so as to establish a *prima facie* case of anticipation.

Chen teaches a process performed on a partially processed substrate 20 having etched metal-containing features 22 and further having etchant byproducts 24, remnant resist 26, and sidewall deposits 27. (*Chen*, col. 4, ll. 45-51.) The sidewall deposits 27 comprise organic compounds containing carbon and hydrogen, metal from the metal-containing layers, such as aluminum, and etchant species such as boron and nitrogen. (*Id.*, col. 5, ll. 16-22.) *Chen* teaches that the exact composition may vary depending upon, *inter alia*, the chemical composition of the metal-containing layers. (*Id.*, col. 5, ll. 22-25.)

However, *Chen* fails to teach or suggest providing an etched substrate having a halogen-containing residue, comprising at least one of chlorine or bromine, formed during etching of a polysilicon layer of the substrate, as recited in claim 1, or providing a substrate having a polysilicon layer on the substrate and etching the polysilicon layer and forming a halogen-containing residue comprising at least one of chlorine or bromine on the substrate, as recited in claim 21. As such, a *prima facie* case of anticipation has not been established because *Chen* fails to teach the “same elements... in exactly the same situation and united in the same way.”

Thus, independent claims 1 and 21, and claims 2-3, 7-9, 10-12, 14-16, 19-20, 22-23, and 29-30 respectively depending therefrom, are patentable over *Chen*. Accordingly, the Applicants respectfully request that the rejection be withdrawn and the claims allowed.

C. 35 USC §102 Claims 1-2, 4, and 7

Claims 1-2, 4, and 7 stand rejected under 35 USC §102(b) as being anticipated by United States Patent 5,306,671, issued April 26, 1994 to Ogawa, *et al.* (hereinafter Ogawa). In view of the amendment to claim 1, the Applicants respectfully disagree.

Ogawa does not identify each of the claimed elements as arranged in independent claim 1 so as to establish a *prima facie* case of anticipation. Ogawa teaches methods of treating a semiconductor substrate surface. In one embodiment, Ogawa teaches removing a fluorine-containing layer 4 from a substrate by heating the substrate and irradiating the layer with ultraviolet rays in an atmosphere of hydrogen radicals. (Ogawa, col. 4, ll. 25-68.) Ogawa further discusses other distinct embodiments of removing fluorine-containing layers. (*Id.*, Figs. 4-5 and accompanying text.)

In another embodiment, Ogawa teaches etching a trench 62 in a silicon substrate 1 using HBr, Cl₂, or SF₆, thereby forming a deposition film 63 on the substrate 1. (*Id.*, col. 7, ll. 1-11.) The deposition film 63 is removed using an HF wet etch. (*Id.*, col. 7, ll. 12-13.) The inner wall surface of the trench 62 is irradiated with ultraviolet rays under a low pressure to remove halogen atoms chemically adsorbed to the inner wall surface of the trench 62. (*Id.*, col. 7, ll. 14-18.) In this embodiment, Ogawa does not teach or suggest exposing the substrate to a plasma or any specific gas or gaseous mixture.

Accordingly, Ogawa fails to teach or suggest providing an etched substrate having a halogen-containing residue, comprising at least one of chlorine or bromine, formed during etching of a polysilicon layer of the substrate; heating the etched substrate to a temperature of at least 50°C; and exposing the heated substrate to a plasma that removes the halogen-containing residue, as

recited in claim 1. As such, a *prima facie* case of anticipation has not been established because *Ogawa* fails to teach the “same elements... in exactly the same situation and united in the same way.”

Thus, independent claim 1, and claims 2, 4, and 7 depending therefrom, are patentable over *Ogawa*. Accordingly, the Applicants respectfully request that the rejection be withdrawn and the claims allowed.

D. 35 USC §102 Claims 1-2 and 7

Claims 1-2 and 7 stand rejected under 35 USC §102(b) as being anticipated by United States Patent Application Publication 2004/0007561, published January 15, 2004 to *Nallan, et al.* (hereinafter *Nallan*). In view of the amendment to claim 1, the Applicants respectfully disagree.

Nallan does not identify each of the claimed elements as arranged in independent claim 1 so as to establish a *prima facie* case of anticipation. *Nallan* teaches methods of plasma etching high-k dielectric materials, such as, for example, HfO₂, ZrO₂, Al₂O₃, BST, PZT, ZrSiO₂, HfSiO₂, HfSiON, TaO₂, and the like. (*Nallan*, ¶[0018].)

However, *Nallan* fails to teach or suggest providing an etched substrate having a halogen-containing residue, comprising at least one of chlorine or bromine, formed during etching of a polysilicon layer of the substrate; heating the etched substrate to a temperature of at least 50°C; and exposing the heated substrate to a plasma that removes the halogen-containing residue, as recited in claim 1. As such, a *prima facie* case of anticipation has not been established because *Nallan* fails to teach the “same elements... in exactly the same situation and united in the same way.”

Thus, independent claim 1, and claims 2 and 7 depending therefrom, are patentable over *Nallan*. Accordingly, the Applicants respectfully request that the rejection be withdrawn and the claims allowed.

E. 35 USC §103 Claims 5-6, 17-18

Claims 5-6 and 17-18 stand rejected under 35 USC §103(a) as being unpatentable over *Ogawa* in view of *Chen*. The Applicants respectfully disagree.

Independent claim 1, from which the above-rejected claims depend, recites limitations not taught or suggested by any permissible combination of the prior art. As discussed above, neither *Chen* nor *Ogawa* teach or suggest the limitations recited in claim 1. Thus, *Chen* fails to teach or suggest a modification of the teachings of *Ogawa* in a manner that would yield providing an etched substrate having a halogen-containing residue, comprising at least one of chlorine or bromine, formed during etching of a polysilicon layer of the substrate; heating the etched substrate to a temperature of at least 50°C; and exposing the heated substrate to a plasma that removes the halogen-containing residue, as recited in claim 1. Therefore, a *prima facie* case of obviousness has not been established as the combination of the cited references fails to yield the limitations recited in the claims.

Thus, claims 5-6 and 17-18 are patentable over *Ogawa* in view of *Chen*. Accordingly, the Applicants respectfully request that the rejection be withdrawn and the claims allowed.

F. 35 USC §103 Claims 13, 31-32

Claims 13 and 31-32 stand rejected under 35 USC §103(a) as being unpatentable over *Chen* in view of *Ogawa*. The Applicants respectfully disagree.

Independent claims 1 and 21, from which the above-rejected claims respectively depend, recite limitations not taught or suggested by any permissible combination of the prior art. As discussed above, *Chen* fails to teach or suggest the limitations recited in claims 1 and 21. As also discussed above, *Ogawa* fails to teach or suggest the limitations recited in claim 1. Independent claim 21 recites limitations similar to claim 1 that are similarly not taught or suggested by *Ogawa*.

Thus, *Ogawa* fails to teach or suggest a modification of the teachings of *Chen* in a manner that would yield providing an etched substrate having a

halogen-containing residue, comprising at least one of chlorine or bromine, formed during etching of a polysilicon layer of the substrate; heating the etched substrate to a temperature of at least 50°C; and exposing the heated substrate to a plasma that removes the halogen-containing residue, as recited in claim 1, or providing a substrate having a polysilicon layer on the substrate; etching the polysilicon layer and forming a halogen-containing residue comprising at least one of chlorine or bromine on the substrate; heating the substrate to a temperature of at least 150°C; and exposing the heated substrate to a plasma that removes the halogen-containing residue, as recited in claim 21. Therefore, a *prima facie* case of obviousness has not been established as the combination of the cited references fails to yield the limitations recited in the claims.

Thus, claims 13 and 31-32 are patentable over *Chen* in view of *Ogawa*. Accordingly, the Applicants respectfully request that the rejection be withdrawn and the claims allowed.

G. 35 USC §103 Claim 24

Claim 24 stands rejected under 35 USC §103(a) as being unpatentable over *Chen* in view of United States Patent 6,265,297, issued July 24, 2001 to *Powell*. However, the Applicants have cancelled claim 24. Accordingly, the rejection is moot.

H. 35 USC §103 Claims 25-28

Claims 25-28 stand rejected under 35 USC §103(a) as being unpatentable over *Chen* in view of United States Patent 6,331,380, issued December 18, 2001 to *Ye, et al.* (hereinafter *Ye*). The Applicants respectfully disagree.

Independent claim 21, from which the above-rejected claims depend, recites limitations not taught or suggested by any permissible combination of the prior art. As discussed above, *Chen* fails to teach or suggest the limitations recited in claim 21. *Ye* generally teaches various methods for patterning underlying layers while providing for easy removal of masking layers and etch chemistries useful for pattern etching organic, polymeric material layers during

formation of contact/interconnect structures. However, Ye fails to teach or suggest a modification of the teachings of *Chen* in a manner that would yield providing a substrate having a polysilicon layer on the substrate; etching the polysilicon layer and forming a halogen-containing residue comprising at least one of chlorine or bromine on the substrate; heating the substrate to a temperature of at least 150°C; and exposing the heated substrate to a plasma that removes the halogen-containing residue, as recited in claim 21. Therefore, a *prima facie* case of obviousness has not been established as the combination of the cited references fails to yield the limitations recited in the claims.

Thus, claims 25-28 are patentable over *Chen* in view of Ye. Accordingly, the Applicants respectfully request that the rejection be withdrawn and the claims allowed.

CONCLUSION

Accordingly, both further consideration of this application and its swift passage to issue are earnestly solicited. If, however, the Examiner believes that any unresolved issues still exist, it is requested that the Examiner telephone Alan Taboada at (732) 935-7100 so that appropriate arrangements can be made for resolving such issues as expeditiously as possible.

Respectfully submitted,

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